UNITED STATES AIR FORCE
AIRCRAFT ACCIDENT INVESTIGATION
BOARD REPORT

HH-60G T/N 91-26354

33RD RESCUE SQUADRON
18TH WING
KADENA AIR BASE, JAPAN

LOCATION: NEAR KADENA AIR BASE, JAPAN

DATE OF ACCIDENT: 5 AUGUST 2013

BOARD PRESIDENT: BRIGADIER GENERAL

STEVEN L. BASHAM

Conducted IAW Air Force Instruction 51-503

Volume 1 of 2

EXECUTIVE SUMMARY
AIRCRAFT ACCIDENT INVESTIGATION

HH-60G, T/N 91-26354
NEAR KADENA AIR BASE, JAPAN
5 AUGUST 2013

On 5 August 2013 at approximately 1610 hours local time (L), the mishap aircraft (MA), an HH-60G, tail number 91-26354, assigned to the 33rd Rescue Squadron, 18th Wing, Kadena Air Base (AB), Japan, while flying in formation on a pre-deployment spin-up training mission, impacted terrain approximately 14 nautical miles northeast of Kadena AB in the Central Training Area (CTA). Mishap Pilot (MP), Mishap Copilot (MCP) and Mishap Aerial Gunner (MAG) exited the MA shortly after impact sustaining minor to major injuries. Mishap Flight Engineer (MFE) was fatally injured. MA was significantly damaged upon impact and subsequently destroyed by ensuing fire with a loss valued at $38,047,154.40. MA impacted on military property, damaging several trees prior to striking the ground. There was no damage to civilian property. There was media interest as reported by local, national and international outlets.

MA was in a formation flight to the CTA as the wingman of the Mishap Flight Lead Aircraft (MFLA). Once in the area, MFLA, followed by MA, infiltrated their pararescuemen into a landing zone near a simulated downed helicopter with a survivor. Following the infiltration, MFLA and MA, now with MA in the formation lead position and MFLA as the trailing aircraft/wingman, proceeded to fly in a northwest-southeast oriented figure eight-like racetrack pattern at 150 feet above ground level. On the last turn prior to the mishap, MA, with MCP on the flight controls, turned to the right (east), and in a direction opposite previous turns in order to correct their pattern, which had drifted to the west. MFLA was at MA's five o'clock position at the beginning of the turn, in an effort to maintain desired gun pattern ground track. There was no indication of discussion or that anyone on the Mishap Crew was aware as to the location of MFLA in relation to MA other than in being in trail. After approximately 90 degrees of turn, MP was surprised to see MFLA off his right side and perceived an immediate conflict with potential for mid-air collision. However, MFLA crew did not have the same perception. Based upon this perception, MP immediately took control of MA, and proceeded to increase bank and initiated a descent to avoid MFLA.

The Accident Investigation Board (AIB) President found by clear and convincing evidence that the cause of the mishap was MP, based upon his perception of a potential for a mid-air collision with the formation wingman, maneuvered MA at low altitude in a manner that resulted in excessive altitude loss and MP's inability to stop the helicopter's descent prior to ground impact. Furthermore, the AIB President found by a preponderance of evidence that each of the following factors substantially contributed to the mishap: (1) MCP turned in a direction opposite previous racetrack turns and into the flight path of the trailing aircraft; and (2) MP was not aware of trailing aircraft's specific position prior to turning, which resulted in MP's surprise upon seeing the trailing aircraft and MP's belief that immediate maneuvering was required to avoid collision.

SUMMARY OF FACTS AND STATEMENT OF OPINION
AIRCRAFT ACCIDENT INVESTIGATION

HH-60G, T/N 91-26354
NEAR KADENA AIR BASE, JAPAN
5 AUGUST 2013

ACRONYMS AND ABBREVIATIONS

15 line	Downed Pilot Mission Guidance
18 AMXS	18th Aircraft Maintenance Squadron
18 MDG	18th Medical Group
18 WG	18th Wing
3 level	Apprentice
31 RQS	31st Rescue Squadron
33 HMU	33rd Helicopter Maintenance Unit
33 RQS	33rd Rescue Squadron
5 AF	Fifth Air Force
5 level	Journeyman
7 level	Craftsman
9 line	Casualty Evacuation Mission Guidance
A1C	Airman First Class
AB	Air Base
AC	Aircraft Commander
ACC	Air Combat Command
ADCC	Assistant Dedicated Crew Chief
ADI	Attitude Directional Indicator
ADO	Assistant Director of Operations
AETC	Air Education and Training Command
AF	Air Force
AFB	Air Force Base
AFE	Aircrew Flight Equipment
AFGM	Air Force Guidance Memorandum
AFI	Air Force Instruction
AFPAM	Air Force Pamphlet
AFSC	Air Force Specialty Code
AFSOC	Air Force Special Operations Command
AFTO	Air Force Technical Order
AGL	Above Ground Level
AHC	Aircraft Handling Characteristics
AIB	Accident Investigation Board
AIE	Alternate Insertion Extraction
AO	Area of Operation
APU	Auxiliary Power Unit
AR	Air Refueling
ATLC	Authentication, Threat, Location, Condition
AWACS	Airborne Warning and Control System
BDA	Battle Damage Assessment
BIM	Blade Inspection Method
Cal	Caliber
CASEVAC	Casualty Evacuation
Capt	Captain
CDU	Central Data Unit
CEP	Communicator Ear Plug
CFACC	Combined Forces Air Component Commander
CG	Center of Gravity
CMR	Combat Mission Ready
Col	Colonel
COMAFFOR	Commander, Air Force Forces
COMPACAF	Commander, Pacific Air Forces
COT	Chief of Tactics
CP	Countermeasure Procedure
CRM	Crew Resource Management
CRO	Combat Rescue Officer
CSAR	Combat Search and Rescue
CTA	Central Training Area
Dash 1 or -1	Technical Order 1H-60(H)G-1 Aircrew Flight Manual
DCC	Dedicated Crew Chief
DME	Distance Measuring Equipment
DNIF	Duties Not to Include Flying
DO	Director of Operations
DOW	Department of Weapons and Tactics
EAG	Evaluator Aerial Gunner
ELMO	Electronic Linked Mission Overlay
EP	Emergency Procedures
ER	Exceptional Release
ETO	Electronic Technical Order
FCIF	Flight Crew Information File
FDR	Flight Data Recorder
FE	Flight Engineer
FENCE	Firepower, Emitters, Navigation Communication, Electronic countermeasures
FLIR	Forward Looking Infrared
Flt CC	Flight Commander
Flt Chief	Flight Chief
Flt Dr	Flight Doctor
Flt Surgeon	Flight Surgeon
FLUG	Flight Lead Upgrade
FM	Frequency Modulation radio
FOD	Foreign Object Damage
FPS	Flight Path Stabilization
FSS/DO	Force Support Squadron Director of Operations
FSO	Flight Safety Officer
GA team	Guardian Angel team
GAU-2/18	Weapon
GPS	Global Positioning System
H2	Hearing level
H3	Hit, Hoist, Hover
H3P	Hit, Hoist, Hover Pilot
Haji	Enemy combatants
HQ	Headquarters
HSI	Horizontal Situation Indicator
IAW	In Accordance With
IC	Incorporating Change
IDMT	Independent Duty Medical Technician
IED	Improvised Explosive Device
IFR	Instrument Flight Rules
IMDS	Integrated Maintenance Data System
IP	Initial Point

IR	Infrared
ISB	Interim Safety Board
ISB Dr	Interim Safety Board Medical Member
ISOPREP	Isolated Personnel
Jack	Survivor
JFACC	Joint Force Air Component Commander
JPRC	Joint Personnel Recovery Center
JTAC	Joint Tactical Air Controller
KIA	Killed In Action
KNOT	Nautical Mile per Hour
L	Local Time
L Attack	Weapons Employment Pattern
LASDT	Low Altitude Step Down Training
LIMFAC	Limiting Factor
LMQT	Local Mission Qualification Training
Lt Col	Lieutenant Colonel
LZ	Landing Zone
MA	Mishap Aircraft
MAG	Mishap Aerial Gunner
Maj	Major
MAJCOM	Major Command
MC	Mishap Crew
MCC	Mishap Crew Chief
MCP	Mishap Copilot
MCRO	Mishap Combat Rescue Officer
MF	Mishap Flight
MFE	Mishap Flight Engineer
MFLA	Mishap Flight Lead Aircraft
MFLAG	Mishap Flight Lead Aerial Gunner
MFLC	Mishap Flight Lead Crew
MFLCP	Mishap Flight Lead Copilot
MFLFE	Mishap Flight Lead Flight Engineer
MFLP	Mishap Flight Lead Pilot
MFLPJ1	Mishap Flight Lead Pararescueman 1
MFLPJ2	Mishap Flight Lead Pararescueman 2
METTT-C	Mission, Enemy, Troops, Time, Terrain, and Civilians
MIRC	Mobile Internet Relay Chat
MK-13	Smoke Flare
MOPP	Mission Oriented Protective Posture
Mortuary	Director of Mortuary Affairs
MOS	Mishap Operations Supervisor
MP	Mishap Pilot
MPCC 1	Mishap Preflight Crew Chief 1
MPCC 2	Mishap Preflight Crew Chief 2
MPJ1	Mishap Pararescueman 1
MPJ2	Mishap Pararescueman 2
MPS	Mishap Production Superintendent
MRI	Magnetic Resonance Imaging
MRO	Medical Review Officer
MSL	Mean Sea Level
Nav	Navigation System
NCOIC	Non Commissioned Officer in Charge
NF	Free Turbine Revolutions Per Minute
NG	Gas Turbine Revolutions Per Minute
NM	Nautical Mile
NOTAMs	Notices to Airmen
NR	Rotor Revolutions Per Minute
NVGs	Night Vision Goggles
OCF	Operation Check Flight
ODO	Operations Desk Officer
OEF	OPERATION ENDURING FREEDOM
OGE	Out of Ground Effect
OIC	Officer in Charge
OPLAN	Operations Plan
Ops	Operations
Ops Sup	Operations Supervisor
Ops Tempo	Operations Tempo
ORM	Operational Risk Management
PA	Public Affairs
PACAF	Pacific Air Forces
PACAF/SG	Pacific Air Forces Surgeon General
PAX	Passengers
PCA	Permanent Change of Assignment
PCS	Permanent Change of Station
PHA	Physical Health Assessment
PID	Positive Identification
PJ(s) or J(s)	Pararescueman (men)
PR	Personnel Recovery
Q1/2/3	Qualified flight Status
Recon	Reconnaissance
ROE	Rules of Engagement
RPA	Remotely Piloted Aircraft
RPG	Rocket Propelled Grenade
RPM	Revolutions per Minute
RTB	Return to Base
SA	Situational Awareness
SABC	Self Aide Buddy Care
SAM	Surface to Air Missile
SATCOM	Satellite Communication
SDH	Simulated Downed Helicopter
SERE	Survival, Evasion, Resistance, Escape
SIB	Safety Investigation Board
SMA	Special Mission Aviator
SME	Squadron Medical Officer
SPI	Special Point of Interest
SQ/CC	33rd Rescue Squadron Commander
SrA	Senior Airman
Stan/Eval	33rd Rescue Squadron Chief of Standardization and Evaluation
TAC	Tactical
TACAN	Tactical Navigation
TCTO	Time Compliance Technical Order
TDY	Temporary Duty
T/N	Tail Number
T.O.	Tech Order
TOC	Tactical Operations Center
TODO	Technical Order Distribution Office Manager
TOLD	Take Off and Landing Data
Tri Tac	Triple Tachometer
TRP	Target Reference Point

TSgt	Technical Sergeant	VHF	Very High Frequency radio
TTP	Tactics, Techniques and Procedures	VSI	Vertical Situational Indicator
UAV	Unmanned Aerial Vehicle	Vol	Volume
UHF	Ultra High Frequency radio	VTR	Video Recording System
U.S.	United States	Vul	Vulnerability period
USAF	United States Air Force	VVI	Vertical Velocity Indication
USNH	United States Naval Hospital	WEZ	Weapons Employment Zone
USPACOM	United States Pacific Command	WIC	Weapons Instructor School
VFR	Visual Flight Rules	Z	Zulu time

The above list was compiled from the Summary of Facts, the Statement of Opinion, the Index of Tabs, and Witness Testimony (Tab V).

SUMMARY OF FACTS

1. AUTHORITY AND PURPOSE

a. Authority

On 8 August 2013, General Herbert J. Carlisle, Commander, Pacific Air Forces (PACAF), appointed Brigadier General Steven L. Basham to conduct an aircraft accident investigation of a mishap that occurred on 5 August 2013 involving an HH-60G aircraft, tail number (T/N) 91-26354, near Kadena Air Base (AB), Japan. The aircraft accident investigation was conducted in accordance with Air Force Instruction (AFI) 51-503, *Aerospace Accident Investigations*, at Kadena AB, from 11 September 2013 through 2 October 2013 and at Hickam Air Force Base, Hawaii from 3 October 2013 to 5 October 2013. As a result of the Government shutdown, the report was not finalized until 23 October 2013. Board members were a Legal Advisor Lieutenant Colonel, a Medical Member Major, a Physiologist Member Captain (Capt), a Pilot Member Capt, a Maintenance Member GS-12, a Recorder Technical Sergeant, and an Administrative Support Member Airman First Class (Tab Y-3 to Y-10).

b. Purpose

This is a legal investigation convened to inquire into the facts surrounding the aircraft or aerospace accident, to prepare a publicly-releasable report, and to gather and preserve all available evidence for use in litigation, claims, disciplinary actions, administrative proceedings, and for other purposes.

2. ACCIDENT SUMMARY

On 5 August 2013 at approximately 1610 hours local time (L), the mishap aircraft (MA), an HH-60G, T/N 91-26354, assigned to the 33rd Rescue Squadron (33 RQS), 18th Wing (18 WG), Kadena Air Base (AB), Japan, while flying in formation on a pre-deployment spin-up training mission, impacted terrain approximately 14 nautical miles (NM) northeast of Kadena AB in the Central Training Area (CTA) (Tab Q-7). Mishap Pilot (MP), Mishap Copilot (MCP) and Mishap Aerial Gunner (MAG) exited MA shortly after impact sustaining minor to major injuries. Mishap Flight Engineer (MFE) was fatally injured (Tab X-3 to X-5). MA was significantly damaged upon impact and subsequently destroyed by ensuing fire with a loss valued at $38,047,154.40 (Tab P-5). MA impacted on military property, damaging several trees prior to striking the ground (Tab H-3). There was no damage to civilian property (Tab P-3). There was media interest as reported by local, national and international outlets (Tab DD-3 to DD-13).

3. BACKGROUND

MA was assigned to the 33 RQS stationed at Kadena AB, Japan. The 33 RQS is a squadron with 18 WG, which falls under Fifth Air Force (5 AF). 5 AF is a Numbered Air Force within PACAF (Tab CC-3 to CC-9).

a. Pacific Air Forces (PACAF)

PACAF's primary mission is to provide Pacific Command integrated expeditionary Air Force (USAF) capabilities to defend the Homeland, promote stability, dissuade/deter aggression, and swiftly defeat enemies. The command's vision is to bring the full power of America's AF and the skill of its Airmen to promote peace and stability in the Asia-Pacific region. PACAF's area of responsibility extends from the west coast of the United States to the east coast of Africa and from the Arctic to the Antarctic, covering more than 100 million square miles. The area is home to 50 percent of the world's population in 36 nations and over one-third of the global economic output. The unique location of the Strategic Triangle (Hawaii-Guam-Alaska) gives our nation persistent presence and options to project United States (U.S.) airpower from sovereign territory (Tab CC-3).

Headquarters (HQ) PACAF, as a Component Major Command (C-MAJCOM), is the United States Air Force's (USAF) first Warfighting headquarters on a MAJCOM scale. The Commander, Pacific Air Forces (COMPACAF) assumes multiple leadership roles: Commander of a USAF MAJCOM, U.S. Pacific Command (USPACOM) Commander of Air Force Forces (COMAFFOR), and the USPACOM Joint Force Air Component Commander (JFACC). HQ PACAF provides AF component support to USPACOM in all operational phases and across the range of military operations. Additionally, HQ PACAF serves as the senior administrative Service headquarters for COMPACAF, performing Service organize, train, and equip functions not appropriate for reach-back (Tab CC-3).

b. Fifth Air Force (5 AF)

5 AF's mission is three-fold. First, 5 AF plans, conducts, controls, and coordinates air operations in accordance with tasks assigned by COMPACAF. 5 AF maintains a level of readiness necessary for successful completion of directed military operations. And last, but certainly not least, 5 AF assists in the mutual defense of Japan and enhances regional stability by planning, exercising, and executing joint air operations in partnership with Japan. To achieve this mission, 5 AF maintains its deterrent force posture to protect both U.S. and Japanese interests, and conducts appropriate air operations should deterrence fail (Tab CC-5 to CC-6).

c. 18th Wing (18 WG)

Kadena AB is the hub of airpower in the Pacific, and home to the AF's largest combat wing, the 18 WG, and a variety of associate units. Together they form "Team Kadena," a world-class combat team ready to fight and win from the Keystone of the Pacific. Kadena's fleet of F-15C/D Eagles; KC-135R/T Stratotankers; E-3B/C Sentries; HH-60G Pave Hawks; MC-130H Combat Talon II's; MC-130P Combat Shadows; RC- and WC- 135s; and Navy P-3 Orions project U.S. deterrence throughout the Western Pacific and South-East Asia, promoting regional peace and stability (Tab CC-7).

d. 33rd Rescue Squadron (33 RQS)

The 33 RQS provides combat and peacetime search and rescue capabilities for COMPACAF. Its primary mission is to recover downed aircrew and isolated personnel from friendly, denied, hostile or sensitive areas. They deploy to conduct combat search and rescue with dedicated, specially trained aircrews and support personnel in response to theater commander taskings. Aircraft and crew qualifications allow performance of rescue operations during military operations other than war. They also conduct missions unique to their capabilities like civil search and rescue, aero medical evacuation, disaster relief and international aid (Tab CC-9).

e. HH-60G Pave Hawk

The primary mission of the HH-60G Pave Hawk helicopter is to conduct day or night personnel recovery operations into hostile environments to recover isolated personnel during war. The HH-60G is also tasked to perform military operations other than war, including civil search and rescue, medical evacuation, disaster response, humanitarian assistance, security cooperation/aviation advisory, National Aeronautics and Space Administration space flight support, and rescue command and control (Tab CC-11).

The Pave Hawk is a highly modified version of the Army Black Hawk helicopter, which features an upgraded communications and navigation suite that includes integrated inertial navigation/global positioning/Doppler navigation systems, satellite communications, secure voice and Have Quick communications. All HH-60Gs have an automatic flight control system, night vision goggles (NVG) with lighting and a forward looking infrared system that greatly enhances night low-level operations. Additionally, Pave Hawks have color weather radar and an engine/rotor blade anti-ice system that gives the HH-60G an adverse weather capability (Tab CC-11).

Pave Hawk mission equipment includes a retractable in-flight refueling probe, internal auxiliary fuel tanks, two crew-served 7.62mm or .50 caliber machineguns and an 8,000-pound (3,600 kilograms) capacity cargo hook. To improve air transportability and shipboard operations, all HH-60Gs have folding rotor blades. Pave Hawk combat enhancements include a radar warning receiver, infrared jammer and a flare/chaff countermeasure dispensing system. HH-60G rescue equipment includes a hoist capable of lifting a 600-pound load (270 kilograms) from a hover height of 200 feet (60.7 meters), and a personnel locating system that is compatible with the PRC-112 survival radio and provides range and bearing information to a survivor's location. Pave Hawks are equipped with an over-the-horizon tactical data receiver that is capable of receiving near real-time mission update information (Tab CC-11).

There are four crewmembers. The pilot, who sits it the front-right seat, is overall responsible for the aircraft, to include, among other things, briefing the crew on the upcoming mission. The copilot, who sits in the front-left seat, assists the pilot and is responsible for, among other things, operating communication and navigation equipment. The flight engineer, who sits in the back-right seat, is responsible for, among other things, ensuring that all maintenance and inspections of the aircraft are completed before takeoff. The aerial gunner, who sits in the back-left seat, is responsible for, among other things, inspection and security of the weapon systems and ordnance

delivery. Both the flight engineer and aerial gunner are responsible for performing scanning duties corresponding to their side in the aircraft. Further, while the pilot at the controls is responsible for controlling the aircraft and avoiding obstacles, the pilot not at the controls should keep the pilot at the controls aware of obstacles out of the pilot's field of vision (Tab BB-16 to BB-17).

4. SEQUENCE OF EVENTS

a. Mission

The 33 RQS was executing a spin-up training program to prepare flight crews for an upcoming deployment to Afghanistan. On 5 August 2013, the mission for the Mishap Flight (MF), a flight of 2 HH-60Gs, was a simulated alert launch, during daylight hours, for a simulated downed helicopter (SDH) with a survivor. The mission's design was to simulate the kind of scramble (method for crews to respond in urgent and specified amount of time) launch mission the 33 RQS personnel could experience while deployed. The simulated ground threat for the mishap was similar to that seen in Afghanistan with small arms fire being a likely enemy course of action (Tab V-1.2 to V-1.6, V-4.3 to V-4.10, V-5.3, V-5.7 and V-11.5).

b. Planning

Mishap Flight Lead Pilot (MFLP) conducted an Alert Standards, and Weapons and Tactics briefing in the weeks prior to the mishap for 33 RQS (Tab V-1.4, V-4.6 and V-4.37). All aircrews attended this briefing. Subsequently, during spin up week, the aircrews received daily update briefs (Tab V-4.6 and V-5.4). The nature of MF's mission required that mission specific data be provided moments prior to launch. Upon the scramble notification, MF took less than 10 minutes to assess the provided information and formulate a game plan (Tab V-1.5 to V-1.6 and V-4.8). Mission planning continued en route, as additional data was received (Tab V-1.5 and V-2.10). Given the type of mission and the frequency in which 33 RQS exercise them, surviving members of the Mishap Crew (MC) felt adequate planning had occurred and standard procedures were followed (Tab V-1.5, V-2.6 and V-4.5). MC consisted of MP, MCP, MFE, and MAG.

c. Preflight

On 5 August 2013, MF received an update brief at approximately 1400L, which included checking all Notices to Airmen (NOTAMs) information, weather data, Flight Crew Information Files (FCIF), weight and balance forms, Takeoff and Landing Data, and Visual Flight Rules flight plan filing (Tab V-1.8, V-2.3, V-4.6 and V-4.8). MC assumed the simulated alert for their vulnerability period at approximately 1400L (Tab V-1.4). Prior to assuming the alert, maintenance conducted the necessary preflight inspections on MA (Tab V-19.2 to V-19.3, V-20.4, V-21.2 to V-21.3, V-22.2 to V-22.4). MCP, MFE and a pilot assigned only for preflight duties (H3P), conducted a preflight and a H3 (Health Indicator Test (HIT), Hover, and Hoist) check (Tab V-18.2 to V-18.3). MA and MFLA were configured with two GAU 18's (.50 caliber guns) each loaded with 300 rounds of .50 caliber ammunition for each gun, approximately 4500 pounds of fuel, alternate extraction insertion devices, and no chaff or flare (Tab V-1.7, V-2.6 to V-2.7, V-3.4 and V-4.9). MFLA was carrying two Pararescuemen (MFLPJ1, MFLPJ2) and a

Combat Rescue Officer (CRO), while MA was carrying two PJs (MPJ1, MPJ2) (Tab V-1.7, V-3.4 and V-4.9).

At approximately 1515L, MF crews received a scramble call (Tab V-4.10). MF crews gathered in the 33 RQS secure vault, simulating a Tactical Operations Center (TOC), to receive initial information on the nature of the scramble, which was a SDH with a survivor (Tab V-2.5 and V-4.10). After, establishing an initial game plan (plan for responding to the situation), all crewmembers except MFLP and MP responded to respective aircraft to initiate scramble launch preflight (Tab V-4.10 to V-4.11). MFLP and MP continued to gain information and went to the aircraft shortly after (Tab V-4.10). MF start, taxi, and takeoff procedures were normal (Tab V-1.9, V-2.7 to V-2.8 and V-4.10).

d. Summary of Accident

MF actual takeoff time was 1535L (Tabs N-4 and U-61). MF flew for approximately 15 minutes to the Initial Point (IP), approximately 14 NMs northeast of Kadena AB (Tabs Q-7, V-3.7 and V-4.28). The scenario for the training mission was located at Landing Zone (LZ) Peacock in the CTA (Tab V-2.40, V-4.28, V-5.12 and V-5.15).

MFLP's game plan, upon arrival at the IP, was to fly a racetrack pattern between the SDH and any potential threat (Tab V-1.9, V-2.12 and V-4.10 to V-4.12) (see Figure 1). Upon arriving at the terminal area and before dropping off the CRO and PJs near the SDH survivor, MF entered into a northwest-southeast oriented gun-pattern racetrack initially planned for 300 feet above ground level (AGL) with MFLA in the formation lead position (Tab V-2.12, V-4.12 to 4.15, V-4.30 and V-4.39).

MF infiltrated the PJs as planned and without incident. MFLA landed in the LZ first and dropped off the CRO and two PJs. MFLA subsequently lifted off and proceeded to fly back into the established racetrack pattern, then cleared MA to land. MA landed, dropped off two PJs, then lifted off and rejoined the racetrack pattern. However, due to the timing of the re-entry into the gun pattern upon takeoff, MA ended up in the formation lead position, although MP is not flight lead certified (Tabs G-83, V-1.12, V-2.12, V-4.12 to V-4.13 and V-9.3) (See Figure 1). This type of formation, where a non-flight lead certified aircraft commander is in the lead, periodically occurs during formation gun procedures in an effort to maximize guns on target (Tab V-1.34 and V-4.13). MCP was on the flight controls of MA on all racetracks after departing the LZ except for the last half of the mishap turn (Tab V-1.14 and V-2.14 to V-2.15).

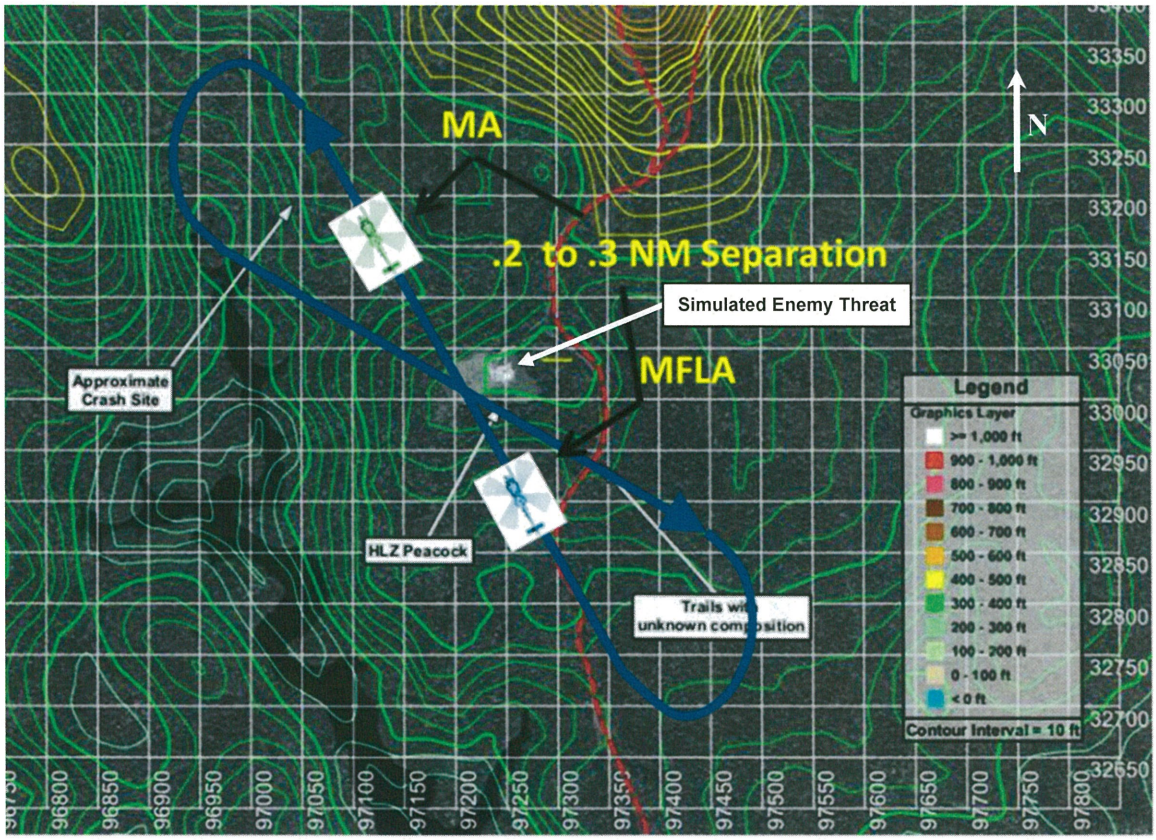

Figure 1. Desired Turn Reversal Racetrack (Tab Z-3)

MF gun pattern following infiltration was at a speed of 80 knots, 150 feet AGL with a separation of .2 to .3 NMs between aircraft (Tab V-1.12, V-2.13, V-4.15, V-4.17, V-4.33, V-5.23) (See Figure 1). All turns on the northwest end of the racetrack were to the left, or west, at maximum-rate-turn bank angles, while turns on the southeast end of the track were reversed and to the right, at the same bank angles (Tab V-2.12, V-2.14, V-4.16 to V-4.17, V-4.30 and V-5.23). The desired straight-and-level portion of the racetrack was between the SDH survivor and simulated enemy forces and on a heading as directed by MFLP on each subsequent turn (Tab V-1.12 to V-1.13, V-2-12, V-4.15 to V-4.16 and V-4.30). Shortly after MF was re-established in the overhead gun pattern, the PJ ground teams were engaged by simulated enemy forces attacking (Tab V-1.12, V-1.30, V-4.13 to V-4.14 and V-4.30). Subsequently, the enemy forces were simulated killed by MF (Tab V-4.13 to V-4.14).

MF continued to fly racetrack patterns, in between the last known enemy threat area and the friendly ground forces. In order to maximize target effect and keep MF between friendly ground forces and the last known enemy threat, MFLP continued to reverse the turns at each end of the racetrack (Tab V-4.12 to V-4.14). MF conducted approximately four to six gun patterns in this manner (Tab V-1.14, V-2.13 and V-4.25). While executing these patterns, the MA, under the control of MCP, allowed its ground track to shift to the west, thus placing the friendly ground forces between the MA and the last known threat area (Tab V-2.14 to V-2.15, V-4.15, V-5.17 to V-5.18 and V-6.3 to V-6.4) (See Figure 2). As noted by MFLP, MA had a weapons engagement confliction or area where they were unable to fire weapons because of the location of the survivor (Tab V-4.15). Therefore, on the last southeast leg of the racetrack, MFLP directed the

MA to correct their pattern by shifting back to the east, to once again place MA between friendly forces and the last known threat area (Tab V-4.15 to V-4.16 and V-6.3 to V-6.4). The pattern shift was acknowledged by the MC (Tab V-4.19 to V-4.21). At the same time, MFLA continued to follow the ground track between survivor and anticipated threat, thus placing it east of MA (Tab V-4.15, V-4.30 and V-5.17 to V-5.18). After the MF turned right to a northeast heading, MFLP noted that MA was still west of desired ground track and MFLP again directed a pattern correction to the east, which again the MC acknowledged (Tab V-4.15 to V-4.16). During all racetracks, the MFLA, flying in the trailing formation position, maintained the desired ground track, which was between the SDH survivor and simulated threat and to the east of the MA ground track on the last racetrack. In order for MFLA to maintain the desired ground track, they had to fly at the seven o'clock position of MA when flying southeast and at the five o'clock position when flying northwest, while maintaining .2 to .3 NMs separation (Tab V-1.32, V-2.34, V-4.15 to V-4.16 and V-4.31). Flying within the 5 o'clock to 7 o'clock position is where MP and MCP stated they would have expected the trailing aircraft to be (Tab V-1.32 and V-2.34).

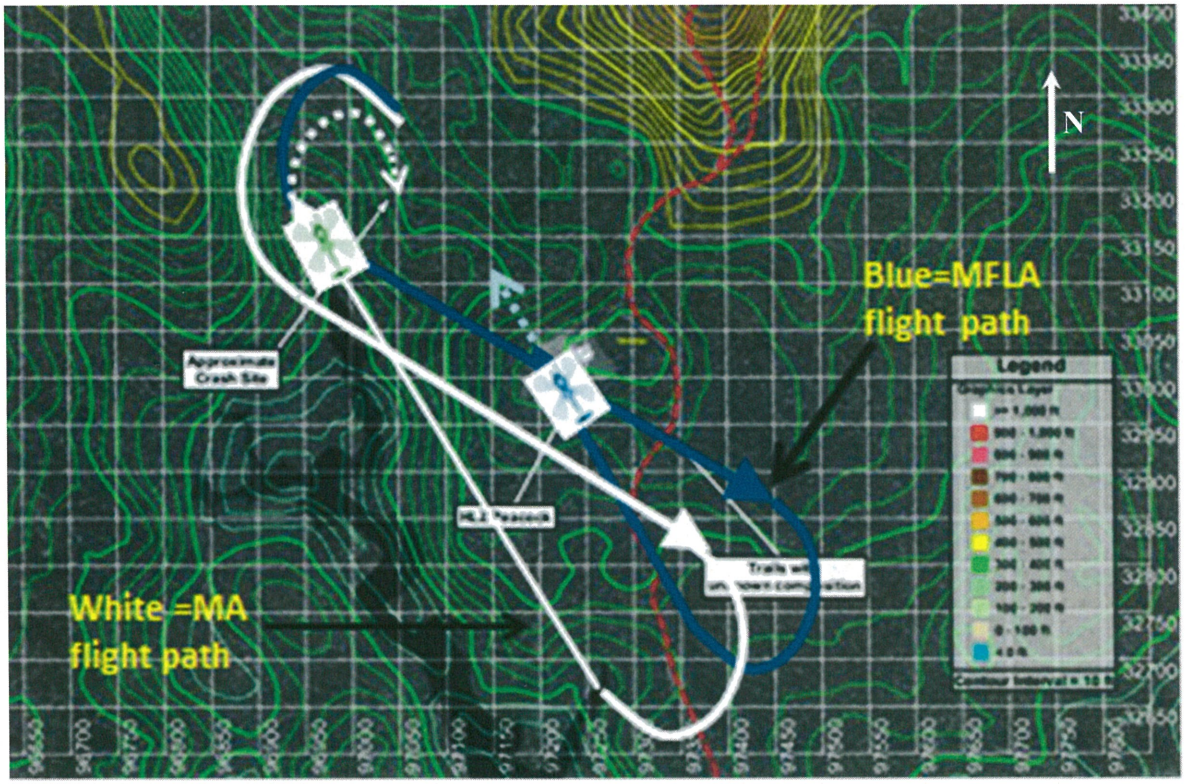

Figure 2. Mishap Aircraft and Mishap Flight Lead Aircraft Separate Ground Track (Tab Z-5)

As MA entered the northwest end of the racetrack pattern, and based on previous patterns, MFLP and MFLCP anticipated MA would perform a left-hand turn as in previous turns (Tab V-4.16 to V-4.17, V-4.31 and V-5.17 to V-5.18). However, MCP chose to execute a right turn in order to shift the pattern to the east, as previously directed by MFLP (Tab V-2.13). This right turn was neither communicated to MFLA nor does MC remember any internal discussions about turning right to fix the pattern (Tab V-1.32, V-2.13, V-2.34 and V-4.31). Per testimony, MP remembered all turns at this end of the track to be to the right, while MCP, MFLP and MFLCP recalled all previous turns being to the left (Tab V-1.31, V-2.13, V-4.16 and V-5.18). Likewise, Mishap Flight Lead Crew (MFLC) did not communicate with MC, as a result of MCP turning in a direction opposite than was expected by MFLP and MFLCP (Tab V-1.32, V-2.34 and V-4.31). However, neither the MFLP nor the MFLCP stated they felt this was a problem because they were deconflicted by distance and believed the MFLA was correcting their pattern spacing to the east by turning to the east, although opposite the direction of previous turns (Tab V-4.16, V-5.18 and V-5.20). MFLA continued straight for approximately five seconds to keep the guns on the right side of the helicopter pointed at the simulated threat for as long as possible then initiated a short turn to the left in order to avoid a conflict and a set up for a subsequent right turn to follow MA (Tab V-4.32 and V-7.4). MFLP stated that just prior to starting the left avoidance turn, the MA had completed approximately 90 degrees of its right turn (Tab V-4.32).

It is at this point, approximately 90 degrees through the maximum performance (turning as fast as possible with the smallest radius possible for a specified airspeed) right turn, MP saw MFLA through the green house window (the window in the ceiling), which was not where MP expected to see MFLA (Tab V-1.14, V-1.30 and V-1.32 to V-1.33) (See Figure 3). MP perceived that MFLA was closing on the MA and there was danger of a midair collision (Tab V-1.14 and V-1.30). However, MFLP, MFLCP, and MFLFE indicated otherwise (Tab V-1.14, V-1.30, V-4.34, V-5.18, V-6.4 and V-7.4). While MFLP acknowledged that had he done nothing with MFLA there would have been a conflict, which is normal for this type of pattern, MFLP negated this conflict by turning to the left, with subsequent intent to follow MA in the right turn (Tab V-4.32). Further MFLP, MFLCP and MFLFE reported no sense of urgency and stated that MA and MFLA remained .2 to .3 NM distance apart (Tab V-4.34, V-5.18 and V-6.4). In addition, the MP stated the MFLA was approximately 1,000 feet at the time he first saw the MFLA (Tab V-1.33).

As a result of his perception, MP took the flight controls from MCP and increased the angle of bank from the 40-50° to an unspecified steeper angle. MP also decreased the collective (the collective changes pitch of the main rotor blades causing an increase or decrease in lift) by approximately 3-4 inches (Tabs V-1.14, V-1.16 to V-1.17, V-1.35, V-2.14 and BB-14). MP's intent was to avoid MFLA's flight path by tightening MA's turn in order to break phase and plane (turn through MFLA's flight path in a descending turn) and reversing the turn to continue around until MA would eventually rejoin behind MFLA in the gun pattern (Tab V-1.15, V-1.30 and V-1.35). While every aircraft ultimately has a responsibility for collision avoidance, in HH-60G gun patterns, the formation lead aircraft is responsible for ground track while the wingman is primarily responsible for spacing and collision avoidance (Tab BB-7). Although MP intended to descend during this maneuver, upon rolling out, MA was lower than MP anticipated (Tab V-1.15, V-1.30 and V-1.38). Realizing MA was about to hit the trees, MP pulled in as much collective as he could but described MA as "mushing through" or "didn't have enough power" in his efforts to stop the descent (Tab V-1.15). At some point during the maneuver, MP and MCP

heard a warning horn from the MA, an indication of either low rotor revolutions per minute (RPM) (below 95%) or compressor gas turbine RPM below 55% (engine failure) (Tabs V-1.15, V-1.36, V-2.12 and BB-15). Due to their attention being drawn outside, neither MP nor MCP could confirm the source of the warning horn (Tab V-1.15, V-1.19 to V-1.20, V-2.12, V-2.17 and V-2.41).

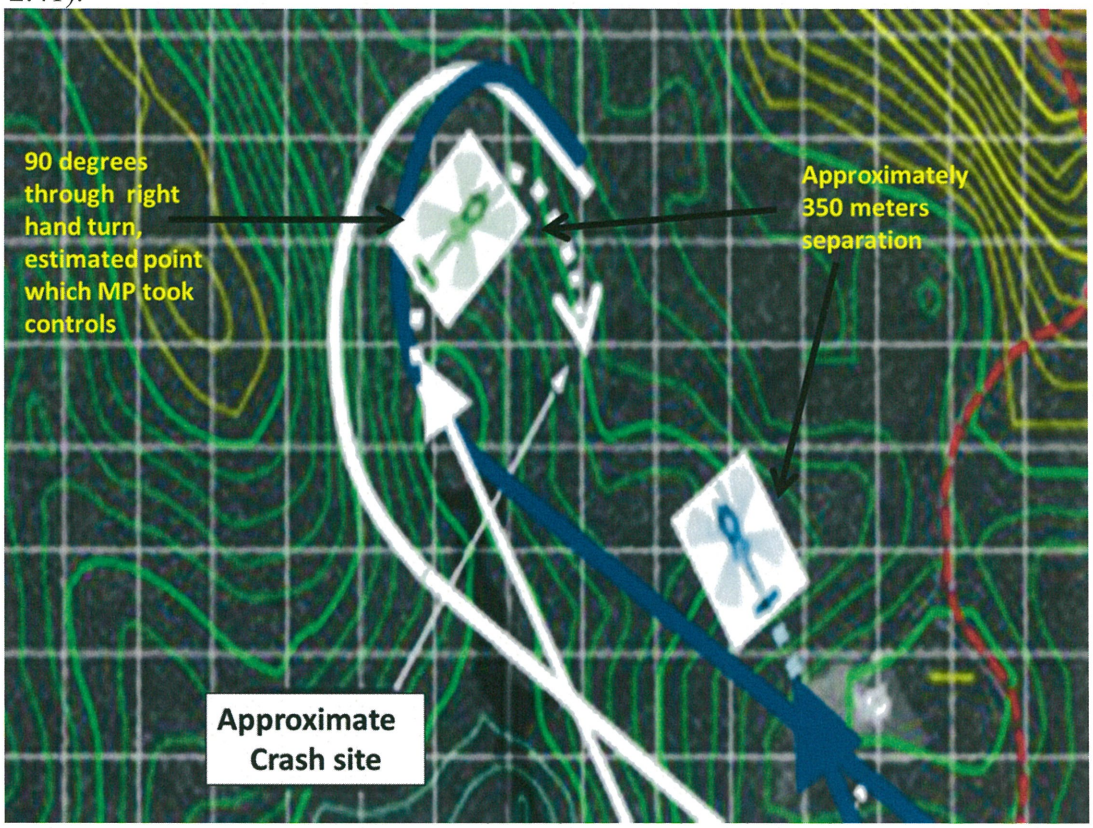

Figure 3. Mishap Pilot's Perceived Conflict Approximate Location (Tab Z-7)

Once MP realized he was unable to recover MA and that descent into the trees was imminent, he decelerated as much as possible in order to enter the trees vertically and with minimal forward airspeed (Tab V-1.39 and V-4.17).

e. Impact

MA impacted the ground into upward sloping terrain at 1610L, approximately 14 NMs northeast of Kadena AB (Tab Q-7). At the time of the impact, MA attitude was assessed to be approximately wings level, nose high, at an unknown rate of descent, and having minimal forward airspeed (Tab V-4.17). MA impacted hard enough to partially stroke MP and MCP's seats (intentional seat design to collapse for aircrew crash survivability). MA rolled onto its right side after impact (Tab V-1.22 and V-2.21). The only change from the original configuration at the time of impact was the weight reduction due to offload of MPJ1 and MPJ2, and fuel burned during flight, estimating fuel remaining to be 4000 pounds (Tab V-1.15).

f. Simulation Analysis

MA parameters and flight control inputs during the final moments of the mishap sequence, as provided by MC and from MFLA witnesses, were reconstructed to the best of the Accident Investigation Board's ability and assessed via simulation as to whether MP would have been able to stop the descent prior to ground impact. Starting parameters for analysis were 150 feet AGL, 80 knots, 50° angle of bank in a level turn (Tabs V-1.14, V-1.16 to V-1.17, V-1.35 and V-2.14). All simulations involved a reduction in torque simultaneously with a steepening in the angle of bank in order to initiate a decent per MP's testimony. Once the decent was established (approximately 2 seconds) the controls were manipulated to affect an immediate recovery. MA parameters from most likely to least likely were as follows: 50-60° angle of bank with 50% torque (approximately 3-4 inch collective reduction) or less, 50° angle of bank with 25% torque (based upon a possible lower initial torque setting or an underestimation of collective reduction) or less, or 60-70° angle of bank with 50% torque or greater. The results of the simulation attempts provided a vertical velocity indication (descent rate), recovery altitude if applicable, and whether the rotor warning horn activated. If the reduction in torque was initiated prior to steepening the aircraft bank angle, rather than simultaneously, nearly every scenario would have impacted the 30-50 foot trees before receiving an audible horn (Tab EE-3 to EE-5).

Utilizing the aforementioned estimated range of parameters, simulation initially assumed no mechanical issues. The calculated most likely range of parameters and flight control inputs resulted in 78% of the attempts being un-recoverable prior to MA impacting the ground. Of the recoverable scenarios, some would have still been below the 30-50 foot tree line. In addition, some of the parameters that allowed for a recovery were re-run adding an engine failure at the point MC described hearing an audible horn. This input was based on the possibility the audible warning MC testified to hearing may have been an engine out warning, rather than a low rotor RPM horn. During these recoverable parameters, recovery was still possible even with an engine failure (Tab EE-3 to EE-5).

g. Egress and Aircrew Flight Equipment (AFE)

MCP was able to egress through an opening in the MA, although MCP cannot remember the specific details. Once out, he checked on the MP who indicated he was stuck. MCP instructed MP that his life vest was caught preventing the MP from egressing. MP told MCP to make sure the throttles were off (Tab V-1.21 to V-1.22 and V-2.21). MCP was able to reach into MA and pull the throttles off (Tab V-2.21 to V-2.24). Both MCP and MP could hear fire crackling and felt the subsequent heat. MP slipped out of his life vest and egressed out of what he believed to be his door opening, which was available due to a natural depression in the ground (Tab V-1.21 to V-1.22 and V-2.21). Due to the speed of the building fire, MP and MCP were forced to move uphill in the two o'clock position from MA (Tab V-1.23 and V-2.22). During this movement, MP and MCP could hear .50 caliber ammunition spontaneously detonate due to the fire (Tab V-1.22 and V-2.21). Once they were a safe distance from the MA, MP and MCP began to administer self-aid buddy care procedures (Tab V-1.23 and V-2.22).

MAG found that he had been thrown between the MFE and MAG seats. MAG was able to egress by utilizing the stokes litter (the basket-like stretcher used for patients) attached to the auxiliary fuel tanks as a type of ladder to climb up and out of the left hand cabin door. MAG

also felt heat, saw fire building quickly in the cabin area, and reported that his pant leg caught fire (Tab V-3.12 to V-3.13). Upon egress, MAG walked downhill away from the mishap site, the opposite direction of MP and MCP (Tab V-3.14). When looking for MFE, none of the surviving MC members recall seeing or hearing him after impact or during their egress (Tab V-1.22, V-2.22 and V-3.12).

g. Search and Rescue (SAR)

MFLCP did not see either MA's descent or impact because MFLA was making a left hand turn and MA was out of his view (Tab V-5.18). However, MFLP immediately recognized the situation and took action to initiate search and rescue procedures. MFLA, returned to LZ Peacock and picked up MFLPJ1, MFLPJ2 and CRO within minutes of the mishap to facilitate an immediate rescue. They returned to the mishap site where they identified the MAG outside the MA (Tab V-4.22 to V-4.24). MFLPJ1 and MFLPJ2 were hoisted down through the trees and quickly assessed the MAG's injuries as critical, and relayed the information to the MFLA (Tab V-4.23, V-5.19 and V-6.6 to V-6.7). MFLFE hoisted the MAG and MFLPJ2 back into MFLA, while MFLPJ1 remained on the ground (Tab V-4.23 and V-6.7). MFLP flew directly to the emergency department helipad at the U.S. Naval Hospital, Camp Foster and dropped off the MAG and MFLPJ2. MFLA returned to the mishap site to continue the search (Tab V-4.23 and V-5.19). Meanwhile, MFLPJ1 located MP and MCP near the mishap site, assessed their injuries, and determined they were stable enough to move (Tab V-1.24 and V-2.23). MFLA subsequently returned to the mishap site where MFLFE hoisted MP, MCP and MFLPJ1 into MFLA. MFLA flew back to the same hospital and dropped off MP, MCP and MFLPJ1 before returning to the mishap location to continue the search (Tab V-4.23 and V-6.7 to V-6.8). By this time, additional rescuers had reached the mishap site on foot and continued to search for MFE (Tab V-9.13). Unable to get close enough to MA, the search was terminated at approximately 0000L and resumed on 6 August 2013 by 0530L (Tab V-9.12 to V-9.13). Throughout the flight and the rescue, there was a great deal of smoke that the rescuers had to deal with (Tab V-4.23, V-5.19 and V-6.7).

h. Recovery of Remains

On 6 August 2013, an extensive search of the crash site was conducted resulting in the discovery of MFE's remains in the location of MFE's seat (Tab V-24.1 to V-24.2). Initial remains and personal effects of MFE were recovered by 33 RQS personnel and provided to personnel from the 18th Force Support Squadron mortuary affairs element who were on scene to effect recovery. All recoverable remains were collected, secured and transported, with appropriate military honors, by the Director, USAF Mortuary Okinawa, to Camp Kinser for processing and identification. Subsequently, MFE's remains were forwarded through appropriate channels to the Office of the Armed Forces Medical Examiner at Dover Air Force Base and were positively identified (Tabs V-24.1 and X-4).

5. MAINTENANCE

a. Forms Documentation

Air Force Technical Order (AFTO) 781 series forms, Integrated Maintenance Data System (IMDS), and Time Compliance Technical Orders (TCTO) document aircraft maintenance and provide a record of inspections, servicing, configuration, status and flight records related to a specific aircraft (Tab U-4).

There was no evidence to suggest that non-compliance with AFTOs was a factor in the mishap. The paper AFTO 781 series forms were onboard at the time of the mishap and were not recovered from the wreckage (Tab D-3). Therefore, the electronic AFTO 781 forms were retrieved from IMDS after the mishap (Tab D-4 to D-21). AFTO 781A series aircraft maintenance forms assigned to MA were thoroughly reviewed. No discrepancies relevant to the mishap were noted. Aircraft engine, flight controls, and hydraulic components were all within prescribed inspection periods. A detailed review of the log books and the AFTO 781s for the 90 days preceding the mishap revealed no evidence of mechanical, structural, or electrical discrepancies (Tabs D-4 to D-21 and U-3 to U-4). A review of the historical records (AFTO 781K), which lists not-complied-with TCTOs, delayed discrepancies and calendar and hourly inspections, disclosed no evidence of discrepancies affecting the airworthiness of the MA (Tab D-14 to D-20).

b. Inspections

A 600-hour phase inspection is accomplished by highly trained crew chiefs and specialists to inspect the aircraft components and airframe for damage, structural integrity and correct systems operation (Tab U-4). MA had accumulated 326.8 hours since the last scheduled 600-hour inspection and was current at the time of the mishap (Tab D-2).

Airframe total time was 5939.6 hours (Tab D-2). The total operating hours for the aircraft engines installed on MA were 1138.3 for engine #1 and 3786.3 for engine #2. The engines together accumulated 326.8 hours since the last required 600-hour inspection. Both engines were installed in MA on 12 June 2012 and were within the required inspection interval for all inspections as documented on the 711C Form (Tab D-2).

A pre-flight inspection was accomplished on 5 August 2013 and a qualified production superintendent reviewed and approved the forms. There was no evidence to suggest that non-compliance with AFTOs or maintenance practices was a factor in the mishap (Tabs U-11 to U-12, V-19.2 to V-19.3, V-20.3, V-20.7, V-21.2 to V-21.3, V-22.2 to V-22.4, and V-23.4 to V-23.5).

c. Maintenance Procedures

A review of MA's AFTO 781 series forms revealed all maintenance actions on MA were accomplished in compliance with standard approved maintenance procedures and technical orders (Tabs D-3 to D-13 and U-3).

There was no evidence to indicate that maintenance procedures were a factor in the mishap.

d. Maintenance Personnel and Supervision

All maintenance activities reviewed were normal and all personnel involved in the preflight, servicing, inspecting, and launch of MA were qualified in their duties. The Special Certification Roster was reviewed to ensure maintenance personnel were qualified for servicing, inspecting, troubleshooting, and releasing the aircraft for flight. Maintenance training records (AF Forms 623 and 797) were reviewed and revealed no training deficiencies (Tab U-3).

e. Fuel, Hydraulic, and Oil Inspection Analyses

No Fuel, Hydraulic or Oil samples were taken due to impact and post-crash fire. A Non-Destructive Inspection was not performed due to amount of destruction of MA caused by fire (Tab U-4).

Bio-Environmental studies were accomplished on water and soil of the crash site on or after 15 August 2013. All samples came back within parameters (Tab U-13 to U-52).

f. Unscheduled Maintenance

In the 60 days prior to the mishap, there were two significant unscheduled maintenance actions performed on MA. On 2 August 2013, the Rescue Hoist Cable was replaced after being shock loaded (excessive load in a rapid time) with 356 pounds on hook (Tabs U-7 and V-23.2). On 23 July 2013, the Yellow Main Rotor Blade was replaced due to Foreign Object Damage (debris impact) (Tab U-9).

A routine pre-flight inspection was performed by qualified maintenance personnel and all aircraft systems and components requiring servicing or inspection were properly documented (Tab U-3 and U-11 to U-12).

There was no evidence to suggest that unscheduled maintenance procedures were factors in the mishap.

6. AIRFRAME, MISSILE, OR SPACE VEHICLE SYSTEMS

a. Structures and Systems

Due to impact and post-crash fire, most parts were badly damaged or unrecoverable. There were no indications that the pre-crash condition of the aircraft systems or structures was a factor in the mishap (Tab D-8 to D-11 and D-18 to D-20).

(1) Parametric Data

The HH-60G does not have an integrated flight data recorder (FDR). Therefore, no FDR data was available (Tab U-4).

(2) Video Recordings

The HH-60G does not have an integrated video recording device. Therefore, no video recording data was available (Tab U-4).

(3) Hydraulic Power System

No samples were taken due to impact and post-crash fire of MA (Tab U-4).

(4) Fuel System

Fuel truck number 589 fueled MA. Fuel from this truck, all equipment items, and storage areas were isolated and sampled. All test samples passed in accordance with Technical Order (T.O.) 42B-1-1 (Tab U-53 to U-60).

(5) Flight Control System

MP testified that he felt as if the right cyclic did not have full movement and MCP stated that they had experienced the same on the previous flight, 1 August 2013 (Tabs G-15, V-1.8 and V-2.8). However, both MP and MCP felt MA responded as it should and they continued the previous and mishap flight (Tab V-1.8 to V-1.9 and V-2.8 to V-2.9). In addition, H3P, who performed the H3 on MA, reported the flight controls had full range of motion (Tab V-18.5). Nothing in the aircraft forms and records showed discrepancies with the flight control system (Tab U-4).

(6) Emergency Power System

MP testified that it felt as if there wasn't enough power with MA just prior to the mishap (Tab V-1.15). During the H3 preflight check, MA demonstrated proper power required for flight (Tab V-18.3). Nothing in the AFTO 781 forms and records showed discrepancies with the aircraft power (Tab U-3 to U-4).

b. Evaluation and Analysis

Further review of AFTO 781 series forms and IMDS revealed that MA had a 00-25-107 (TAR 2013-00020) Engineering Disposition (engineering authority to fly an aircraft outside of normal technical data). MA sustained battle damage and was cleared for flight on 4 January 2013. There is no evidence that the previous battle damage was a factor in the mishap (Tab U-5 to U-6).

7. WEATHER

a. Forecast Weather

Weather was forecast to be scattered variable to broken from 1500 feet mean seal level (MSL) to 10000 feet MSL with winds from 240 degrees, or from the southwest, at 10 knots. Forecasted hazards were isolated rain showers at 10000 feet MSL (Tab F-4 to F-5).

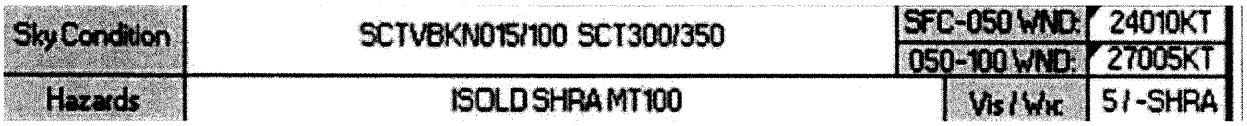

Figure 4. Meteorological Aviation Report (Tab F-5)

b. Observed Weather

Aircrew stated it was sunny, good visibility, light winds, and no notable ceiling (Tab V-1.7, V-4.9 and V-5.7).

c. Space Environment

Not applicable.

d. Operations

MF was filed as a visual flight rules flight plan and flown in good visual meteorological conditions (Tab V-4.9).

8. CREW QUALIFICATIONS

a. Mishap Pilot (MP)

MP was a current and qualified HH-60G Mission Pilot (Tab K-24). He had 708.9 total hours. More specifically, he had 495 HH-60G hours, 273.2 aircraft commander hours, 99.5 combat hours, and 197.1 NVG hours (Tab G-12). MP was considered a good pilot with good aircraft control as well as great general knowledge (Tab V-4.3 and V-11.6).

Recent flight time is as follows (Tab G-8):

	Hours	Sorties
Last 30 Days	26.6	13
Last 60 Days	44.5	26
Last 90 Days	53.7	30

b. Mishap Copilot (MCP)

MCP was a current and qualified HH-60G Copilot (Tab K-24). He had 615.3 total hours (Tab G-24 to G-25). More specifically, 401.4 HH-60G hours, 145.7 combat hours, and 103 NVG hours (Tab G-28). MCP was described as an average to above average copilot (Tab V-11.8).

Recent flight time is as follows (Tab G-24):

	Hours	Sorties
Last 30 Days	15.4	6
Last 60 Days	18.7	7
Last 90 Days	26.1	12

c. Mishap Flight Engineer (MFE)

MFE was a current and qualified HH-60G Flight Engineer (Tab K-24). He had 867.3 total hours as a Flight Engineer. More specifically, 34.8 hours of instructor time, 258.8 combat time and 352.3 NVG hours (Tab G-42). MFE was well respected within the squadron and considered an expert in his craft (Tab V-11.7, V-16.5 and V-29.5).

Recent flight time is as follows (Tab G-38):

	Hours	Sorties
Last 30 Days	22.3	9
Last 60 Days	51.0	35
Last 90 Days	71.1	46

d. Mishap Aerial Gunner (MAG)

MAG was a current and qualified HH-60G Aerial Gunner (Tab K-24). He had 241.5 total hours. More specifically, 240.3 total hours as an Aerial Gunner and 115.6 NVG hours (Tab G-59). MAG was relatively new to his position and had recently required additional instruction and supervision (Tab V-17.4).

Recent flight time is as follows (Tab G-55):

	Hours	Sorties
Last 30 Days	23.3	9
Last 60 Days	30.8	13
Last 90 Days	41.1	18

e. Mishap Flight Lead Pilot (MFLP)

MFLP was a United States Air Force Weapons School graduate and a current and qualified HH-60G Instructor Pilot and Flight Lead certified (Tabs G-288, K-22 and V-5.28). He had 1626.8 total hours. More specifically, 1394.3 HH-60G hours, 978.2 aircraft commander hours, 247.2 instructor hours, 306.8 combat hours and 612.3 NVG hours (Tab G-73). MFLP is considered an excellent pilot, instructor, and officer and is respected by leadership (Tab V-11.6).

Recent flight time is as follows (Tab G-68):

	Hours	Sorties
Last 30 Days	13.5	5
Last 60 Days	39.1	23
Last 90 Days	62.0	42

There was no evidence to suggest that discrepancies or deficiencies in crew qualifications were factors in the mishap.

9. MEDICAL

a. Qualifications

(1) Mishap Pilot (MP)

MP was medically qualified to perform flying duties at the time of the mishap (Tabs R-4 to R-10, V-1.27, V-26.3 to V-26.4 and X-3). MP's annual Preventative Health Assessment (PHA) and his AF Form 1042 (medical clearance to fly) were current at the time of the mishap (Tabs V-26.3 to V-26.4 and X-3). MP's most recent flight physical and PHA were both performed on 20 June 2013 (Tabs V-26.3 to V-26.4 and X-3). Furthermore, MP had no physical or medical restrictions and was worldwide qualified prior to the mishap (Tab X-3).

MP suffered minor injuries consistent with the mishap and was evaluated by United States Naval Hospital (USNH) Okinawa Emergency Department (Tabs V-1.25, V-6.7 to V-6.9, V-27.3, and X-3 to X-5). MP has made a full recovery and after Flight Surgeon evaluation was returned to flight status on 16 August 2013 (Tabs V-1.28 and X-3).

(2) Mishap Copilot (MCP)

MCP was medically qualified to perform flying duties at the time of the mishap (Tabs R-11 to R-19, V-2.26 to V-2.27, V-26.3 to V-26.5, V-27.6 to V-27.7, V-30.3, and X-4). MCP's annual PHA and AF Form 1042 were current at the time of the mishap (Tabs V-2.26 to V-2.27, V-26.3 to V-26.5 and X-4). MCP's most recent flight physical and PHA were both performed on 18 June 2013 (Tabs V-2.26 to V-2.27, V-26.3 to V-26.4 and X-4). Furthermore, MCP had no physical or medical restrictions and was worldwide qualified prior to the mishap (Tabs V-2.26 to V-2.28 and X-4).

MCP suffered minor injuries consistent with the mishap. MCP was admitted to and evaluated by United States Naval Hospital (USNH) Okinawa Emergency and General Surgery Departments (Tabs V-2.28, V-6.7 to V-6.9, V-27.3 and X-3 to X-5). Currently MCP is progressing to a full recovery while his status remains as duties not to include flying (DNIF) (Tabs V-2.27 and X-4).

(3) Mishap Flight Engineer (MFE)

MFE was medically qualified to perform flying duties at the time of the mishap. MFE's annual PHA and his AF Form 1042 were current at the time of the mishap. MFE's most recent flight physical and PHA were both performed on 10 June 2013 (Tabs V-26.3 to V-26.4 and X-4). MFE was DNIF on 11 July 2013 for a minor elective procedure and returned to flight status 11 days later, on 22 July 2013. Furthermore, MFE had no physical or medical restrictions and was worldwide qualified prior to the mishap (Tab X-4).

MFE sustained fatal injuries from the mishap (Tab X-4).

(4) Mishap Aerial Gunner (MAG)

MAG was medically qualified to perform flying duties at the time of the mishap. MAG's annual PHA and his AF Form 1042 were current at the time of the mishap (Tab X-5). MAG's most

recent flight physical and PHA were both performed on 21 May 2013 (Tabs V-26.3 to V-26.4 and X-5). Furthermore, MFE had no physical or medical restrictions and was worldwide qualified prior to the mishap (Tab X-5).

MAG suffered major injuries during the mishap and was admitted to USNH Okinawa for three days (Tabs V-3.17, V-27.3 and X-3 to X-5). Currently MAG is making a full recovery while remaining DNIF after the mishap (Tabs V-3.17 and X-5).

b. Health

Medical records and individual histories revealed all individuals were in good health and had no recent performance-limiting illnesses prior to the mishap. After thoroughly reviewing the material described above, there was no evidence that any medical condition were factors in the mishap (Tab X-3 to X-5).

c. Pathology

Toxicology tests were conducted for MP, MCP, MAG, and aircraft maintenance members. The carbon monoxide, ethanol and drug screening results were within normal limits or consistent with post-mishap medical care medication/pain control or previously prescribed medications (Tabs V-1.28, V-2.28, V-3.18, V-27.6, V-30.1 and X-3 to X-5). There is no evidence that drug use was a factor in the mishap (Tab X-3 to X-5).

Toxicology tests were not performed on MFE (Tab X-4).

d. Lifestyle

After a review of MP, MCP, MFE (to the extent reconstructed by his spouse) and MAG 72-hour and 14-day histories and testimonies did not reveal any lifestyle factors, including unusual habits, behavior or stresses, there is no evidence to suggest they were a factor in the mishap (Tabs R-4 to R-28, V-1.29, V-2.16, V-3.16 to V-3.18,V-5.29, V-26.4, V-27.6, V-30.2 and X-3 to X-5).

e. Crew Rest and Crew Duty Time

Air Force pilots are required to have "crew rest" prior to performing in-flight duties, in accordance with AFI 11-202, Vol. 3, *General Flight Rules*, PACAF Supplement, 11 July 2011, paragraph 9.8, which states, "[a]ircrew require at least 10 continuous hours of restful activities (including an opportunity for at least 8 hours of uninterrupted sleep) during the 12 hours immediately prior to FDP [Flight Duty Period]." Paragraph 9.4.5 states, "[t]he crew rest period prior is normally a minimum 12-hour non-duty period before the FDP begins. Its purpose is to ensure the aircrew member is adequately rested before performing flight or flight related duties. Crew rest is free time, and includes time for meals, transportation, and rest. Rest is defined as a condition that allows an individual the opportunity to sleep."

There is no evidence to suggest that inadequate crew rest was a factor in the mishap (Tabs R-4 to R-28, V-1.27, V-1.29, V-2.26, V-2.29, V-3.16 and X-3 to X-5). MP's 72-hour and 14-day history showed ample crew rest, but minor fatigue and poor sleep hygiene (controlling

behavioral and environmental factors that proceed and may interfere with sleep) were noted (Tabs R-4 to R-10 and X-3). A fatigue analysis using the Fatigue Avoidance Scheduling Tool program was conducted, however the results were inconclusive due to poor data fidelity. This was due to length of time from mishap and limited recall of specific work/rest data (Tabs R-4 to R-10, V-1.27 to V-1.29 and X-3).

10. OPERATIONS AND SUPERVISION

a. Operations

The members of MF received pertinent training and instruction on tactics techniques and procedures, standards, and formation contracts (Tab V-4.2 to V-4.4, V-4.6, V-4.8 and V-4.14). The 33 RQS has a high ops tempo where members typically deploy about fifty percent of their time assigned. While at home station, training continues at a high tempo in order to prepare for the constant deployments (Tab V-12.4). The crews were set up as hard crews (same crewmembers designated to fly together on a continual basis) and were training for an upcoming deployment employing a crawl, walk, run technique (Tab V-1.2, V-2.5, V-4.6, V-11.4 to V-11.5 and V-11.7). They were working 12-hour work days in order to simulate the 12-hour vulnerability periods to be covered down range (Tab V-4.25). They were in the second week of this training and in the "walk fast to run" phase (Tab V-11.5). The crews had flown night flights the week before but had a weekend to reset in order to fly a day flight (Tab V-2.26 and V-4.27). There is no evidence to suggest operations were a factor in the mishap.

b. Supervision

All members of MF were required to, and did, attend an alert standards brief as well as daily update briefs prior to flying any training lines (Tab V-10.3). All FCIFs and NOTAMs were checked by MFLP and the operations desk officer (Tabs K-12 to K-21, V-2.3, V-4.6, V-4.9 and V-10.2 to V-10.3). Flight commander, assistant directors of operations, chief of weapons and tactics, and Squadron Commander were all involved at their appropriate level with deployment crew / flight compliments, spin up training, as well as concept of operations concerning training scenarios (Tab V-4.5 to V-4.6, V-10.6 and V-11.4 to V-11.5). There is no evidence to suggest supervision was a factor in the mishap.

11. HUMAN FACTORS

a. Introduction

AFI 91-204, *Safety Investigations and Reports,* 24 September 2008, Attachment 5, contains the Department of Defense Human Factors Analysis and Classification System which lists potential human factors that can play a role in aircraft mishaps.

b. Cross-Monitoring Performance (PP102)

AFI 91-204, page 130 defines cross-monitoring performance as a factor when crew or team members failed to monitor, assist or back-up each other's actions and decisions.

MC failed to recognize that the final right-hand turn (which was opposite previous directions at this end of the racetrack) would be in the direction of the MFLA, which was at their 5 o'clock position (Tab V-1.29, V-2.13 and V-3.11). MC received a shift pattern east call, to which MCP initiated a right turn to the east, although neither MP nor MCP recall any internal communication as to the choice of turning right being different than previous turns (Tab V-1.32, V-2.12 to V-2.13 and V-2.34). MP did not recall that this turn direction was different than previous turns (Tab V-1.31 to V-1.32). Likewise, surviving members of MC did not recall whether or not there was any internal communication as to clearing MA's flight path relevant to MFLA (Tab V-1.29, V-2.13 and V-3.11).

c. Misperception of Operational Conditions (PC504)

AFI 91-204, page 129 defines misperception of operational conditions as a factor when an individual misperceives or misjudges altitude, separation, speed, closure rate, road/sea conditions, aircraft/vehicle location within the performance envelope or other operational conditions and this leads to an unsafe condition.

MP perceived a situation unfolding that if uncorrected would lead MF into a situation that would prevent either aircraft from having enough energy to maneuver as required, although evidence suggests otherwise. (Tab V-1.14 to V-1.15, V-1.38, V-4.32, V.34, V-4.37 and V-5.18). Due to MA displacement from the desired ground track, MFLP chose to fly the desired ground track putting them at MA's 5 o'clock position, where MP and MCP stated they would have expected MFLA to be (Tab V-1.18, V-1.32, V-2.34, V-4.15 and V-4.31). MFLAG detected MA's right-hand turn, which was in the direction of MFLA's flight path, and alerted MFLP to the condition that if left uncorrected would lead to a conflict. Since this type of potential conflict is common in this formation pattern, MFLP assessed there was adequate space to continue flying ahead for approximately five seconds to complete the gun pattern before turning to avoid a conflict (Tab V-4.32, V-5.18, V-6.5 and V-7.3). At the end of the five seconds and just prior to MFLP initiating the turn to the left is when MP sees MFLA at approximately 1,000 feet away (Tab V-1.33 and V-4.32). MFLP and MFLCP experienced no significant sense of urgency as the situation progressed; nor did they feel the need to communicate their intentions with MA (Tab V-4.31, V-4.34, V-5.18 and V-5.21). MP felt MA and MFLA where going to hit each other although MFLP and MFLCP, who were continually watching MA throughout the right turn, perceived the separation was appropriate (Tab V-1.14, V-1.30, V-4.32 to V-4.34,V-5.18, V-6.4 and V-7.4).

d. Overcontrol / Undercontrol (AE104)

AFI 91-204, page 116 defines overcontrol / undercontrol as a factor when an individual responds inappropriately to conditions by either overcontrolling or undercontrolling the aircraft / vehicle / system. The error may be a result of preconditions or a temporary failure of coordination.

MP recalled in detail the actions that he took to maintain adequate separation from MFLA. MP testified that after MCP initiated a right hand turn, MP perceived a possible conflict between MA's and MFLA's flight paths. Upon detection of the impending conflict, MP took control of MA, and made flight control inputs to further increase the rate of turn while simultaneously

descending to gain separation (Tab V-1.15). However, MP's controlling of MA resulted in a loss of altitude greater than allowable due to terrain (Tab V-1.15, V-4.17 and V-6.4).

There is evidence to suggest these human factors were factors in the mishap.

12. GOVERNING DIRECTIVES AND PUBLICATIONS

a. Publically Available Directives and Publications Relevant to the Mishap

(1) AFI 11-202, Vol 1, *Aircrew Training*, 22 November 2010
(2) AFI 11-202, Vol 2, *Aircrew Standardization/Evaluation Program*, 13 September 2010, Incorporating Change (IC) 1, 18 October 2012
(3) AFI 11-202, Vol 3, *General Flight Rules*, 22 October 2010
(4) AFI 11-202, Vol 3, PACAF Supplement, *General Flight Rules*, 11 July 2011
(5) AFI 11-214, *Air Operations Rules and Procedures*, 14 August 2012
(6) AFI 11-2HH-60, Vol 1, *HH-60 Aircrew Training*, 7 May 2010
(7) AFI 11-2HH-60, Vol 2, *HH-60 Aircrew Evaluation Criteria*, 10 August 2007
(8) AFI 11-2HH-60, Vol 3, *HH-60--Operations Procedures*, 5 January 2011
(9) AFI 11-418, 18 WG Supplement, *Operations and Supervision*, 13 June 2013
(10) AFI 48-123, *Medical Examinations and Standards*, AF Guidance Memorandum (AFGM) 4, 29 January 2013
(11) AFI 51-503, *Aerospace Accident Investigations*, 28 May 2010
(12) AFI 91-204, *Safety Investigations and Reports*, AFGM 1, 9 August 2012

NOTE: All directives and publications listed above are available digitally on the Air Force Departmental Publishing Office website at: http://www.e-publishing.af.mil.

b. Other Directives and Publications Relevant to the Mishap

(1) Air Force Tactics, Techniques, and Procedures (TTP) 3-3.HH-60G, *Combat Aircraft Fundamentals HH-60G*, 28 October 2011
(2) Base Order 3500.1C, *Standing Operating Procedures for the Central Training Area Ranges, Training Areas and Airspace*, 28 September 2009
(3) In Flight Guide, Appendix A (Exercise), 15 February 2011
(4) In Flight Guide, Appendix B (Avionics), 15 February 2011
(5) In Flight Guide, Appendix C (Local Instrument Procedures), 15 February 2011
(6) T.O. 1H-60(H)G-1, *HH-60G Helicopter Flight Manual*, 30 June 2009, IC 12, 11 January 2013
(7) T.O. 1H-60(H)G-1 CL -1, *HH-60G Helicopters Pilot's Flight Crew Checklist*, 30 June 2009, IC 3, 28 June 2012
(8) T.O 1H-60(H)G-1 CL -2, *HH-60G Helicopters Gunner/Hoist Operators Flight Crew Checklist*, 30 June 2009, IC 4, 26 October 2012
(9) Official Air Force Approved Aircrew Medications, Effective 31 March 2008
(10) Hearing Loss/Asymmetric Hearing Loss/Use of Hearing Aid(s) Waiver Guide, June 2011

c. Known or Suspected Deviations from Directives or Publications

There were no noted deviations from directives or publications in the mishap.

13. ADDITIONAL AREA OF CONCERN

An additional area of concern is the training and experience non-Flight Lead certified HH-60G pilots gain as formation lead. MP found himself in the formation lead position approximately 10% or less of his HH-60G sorties (Tab V-1.34). Because of this potentially limited experience in the formation lead position, he may not have been fully prepared to respond appropriately as formation lead (Tab V-1.15). When faced with a perception of possible collision, MP felt compelled to take primary responsibility for collision avoidance without communicating with trailing aircraft, which was in a better position for collision avoidance and in accordance with HH-60G TTPs has the greater responsibility (Tabs V-1.15, V-1.35 and BB-7).

Steven L Basham

23 October 2013

STEVEN L. BASHAM
Brigadier General, USAF
President, Accident Investigation Board

STATEMENT OF OPINION

HH-60G, T/N 91-26354
NEAR KADENA AIR BASE, JAPAN
5 AUGUST 2013

Under 10 U.S.C. § 2254(d) the opinion of the accident investigator as to the cause of, or the factors contributing to, the accident set forth in the accident investigation report, if any, may not be considered as evidence in any civil or criminal proceeding arising from the accident, nor may such information be considered an admission of liability of the United States or by any person referred to in those conclusions or statements.

1. OPINION SUMMARY

I find by clear and convincing evidence that the cause of the mishap was Mishap Pilot (MP), based upon his perception of a potential for a mid-air collision with the formation wingman/trailing aircraft, maneuvered Mishap Aircraft (MA) at low altitude in a manner that resulted in excessive altitude loss and MP's inability to stop the helicopter's descent prior to ground impact.

Furthermore, I find by a preponderance of evidence that each of the following factors substantially contributed to the mishap:

a. MCP turned in a direction opposite previous racetrack turns and into the flight path of the trailing aircraft; and

b. MP was not aware of trailing aircraft's specific position prior to turning, which resulted in MP's surprise upon seeing the trailing aircraft and MP's belief that immediate maneuvering was required to avoid collision.

2. DISCUSSION OF OPINION

On 5 August 2013 at approximately 1610 hours local time (L), the MA, an HH-60G, tail number 91-26354, assigned to the 33rd Rescue Squadron (33 RQS), 18th Wing, Kadena Air Base (AB), Japan, while flying in formation on a pre-deployment spin-up training mission, impacted terrain approximately 14 nautical miles (NM) northeast of Kadena AB in the Central Training Area. MP, Mishap Copilot (MCP) and Mishap Aerial Gunner exited the MA shortly after impact sustaining minor to major injuries. Mishap Flight Engineer was fatally injured. MA was significantly damaged upon impact and subsequently destroyed by ensuing fire with a loss valued at $38,047,154.40. MA impacted on military property, damaging several trees prior to striking the ground. There was no damage to civilian property. There was media interest as reported by local, national and international outlets.

MA was in the formation lead position on the gun pattern racetracks at 150 feet above ground level as a result of normal mission-related sequence of events and Mishap Flight Lead Aircraft (MFLA) was trailing at .2 to .3 NMs in the 5 o'clock position. Just prior to the mishap, MCP

made a right turn to the east, which was opposite previous turns, and toward MFLA's flight path, which was unexpected by Mishap Flight Lead Pilot (MFLP) and Mishap Flight Lead Copilot (MFLCP). Although MCP states that he turned to the east in order to shift the pattern as directed by MFLP, neither the MP nor MCP recall any discussion pertaining to the turn being opposite the previous turn direction. In fact, as a part of his testimony, MP did not believe the turn was opposite previous turns. Likewise, neither MP nor MCP indicated any discussion as to the location of the trailing aircraft prior to initiating their turn. Although, the MP and MCP stated they would have expected the MFLA to be between their five to seven o'clock position. Based upon the calls to shift the pattern to the east by MFLP, MP and MCP should have anticipated that MFLA's ground track could be to the east of their ground track, or at their five o'clock position, and on the side to which they were turning. However, neither the MP nor MCP recall any discussion as to the location of the MFLA prior to initiating the turn.

It is clear that MP did not have sight of MFLA prior to MCP turning toward MFLA's flight path as evidenced by his surprise at seeing MFLA in his 3 o'clock position with a vector in MA's direction. In fact, this is likely the first time MP would have seen MFLA in a turn on this end of the racetrack since previous turns would have been to the west and away from MFLA. After seeing MA start a turn in a direction opposite than expected, MFLA continued straight for approximately 5 seconds on the desired ground track before initiating a short turn to the left followed by a right turn with intent of following MA, in order to avoid a conflict.

Based upon seeing MFLA in this position, MP perceived a potential for mid-air collision and immediately took control of the aircraft. Through testimony of MFLP, MFLCP and MFLAG, there is no indication that the distance between MA and MFLA put MA in danger of a mid-air collision. Approximately 5 seconds after MA started to turn, MFLP made a short turn to the left in order to avoid a conflict with MA. However, it is possible that MP saw MFLA close to the time MFLA was starting to turn and did not perceive MFLA initiating avoidance maneuvering. As a result, MP took control of MA and initiated avoidance maneuvering by increasing MA's bank angle while starting a descent in an attempt to turn tighter than currently planned and not crossing MFLA's flight path.

Simulation analysis of the most likely range of maneuvering parameters, as provided by MP and other witness testimony, resulted in MA with no aircraft mechanical malfunctions being un-recoverable prior to impacting the ground during 78% of the attempts, though some of the recoverable scenarios would have still been below the 30-50 foot tree line. Some of the parameters that were recoverable without mechanical failure were again tested with an engine failure considering the possibility that the audible horn described by MP and MCP was the engine out warning horn rather than a low rotor revolutions per minute warning horn. In these instances, the simulation analysis indicated that a recovery was still possible with an engine failure. Lacking any discernible evidence to the contrary, I concluded that maintenance was not a factor in the mishap. That being said, if the audible horn experienced by MP and MCP was the engine out warning horn and MA was within recoverable parameters, MP should have been able to stop the descent prior to ground impact based upon simulation evidence. As a result, the most likely parameters entered into by MP were in the range of those that were not recoverable or were beyond MP's capability for recovering. Therefore, simulation analysis of MP flight control inputs during the final moments of the mishap sequence indicate MP's overcontrolling of MA at

inputs during the final moments of the mishap sequence indicate MP's overcontrolling of MA at low altitude caused excessive altitude loss; and although MP was able to level and decelerate the MA, he was not able to stop the descent prior to entering the trees or impacting the ground.

3. CONCLUSION

I find by clear and convincing evidence that the cause of the mishap was MP, based upon his perception of a potential for a mid-air collision with the formation wingman, maneuvered MA at low altitude in a manner that resulted in excessive altitude loss and MP's inability to stop the helicopter's descent prior to ground impact. Furthermore, I find by a preponderance of evidence that each of the following factors substantially contributed to the mishap: (1) MCP turned in a direction opposite previous racetrack turns and into the flight path of the trailing aircraft; and (2) MP was not aware of trailing aircraft's specific position prior to turning, which resulted in MP's surprise upon seeing the trailing aircraft and MP's belief that immediate maneuvering was required to avoid collision. I developed my opinion by analyzing factual data from witness testimony, historical records, Air Force directives and guidance, animated simulations and information provided by technical experts.

Steven L. Basham

23 October 2013

STEVEN L. BASHAM
Brigadier General, USAF
President, Accident Investigation Board

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